Shape Corp.

TOOL QUOTE AND BUILD MANUAL

Check Fixture and Gage Specifications
2435212-VEI
March 2020

Mission Statement

The Shape Corp. team will:
Supply products through diverse manufacturing services to a worldwide market.
Commit our resources to anticipate and fulfill our customers' needs and quality requirements.
Endeavor through ethical business practices, to produce wealth for our customers, employees, stockholders and communities.

Statement of Confidentiality

shape CORP. | THINKERS. BELIEVERS. DOERS.

CHECK FIXTURE & GAGE SPECIFICATIONS

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CHECK FIXTURE & GAGE SPECIFICATIONS

1. REVISION LOG:

1.1. Section 6.3: Added - Variable data port/SPC port bushing sizes.
1.2. Section 3.5: Added Reach safety requirements.
1.3. Section 10.2.A.2: Updated requirements for Drill Bushings
1.4. Section 6.11.D: Added requirement for a greentag shelf to carts.

2. GENERAL

2.1. Definitions

2.1.A. Fixture - A device that is used to hold a part while various operations are performed on it. For instance, a fixture is used to hold the part while milling or CMM inspection is performed.

2.1.B. Gage - An instrument that is used to measure the part. For the purpose of this document, the criteria for calipers, micrometer e.g. are not specifically addressed. It does, however provide instructions or guidelines that could be used with this type of equipment.

2.1.C. Check Fixture/gage - a fixture with a gage, e.g. SPC indicator port, attached to it. The fixture is the gage and the terms are used interchangeably.

2.1.D. Holding Fixture - a fixture that has no measuring instrument attached to it.

2.2. Warranty

2.2.A. The gage supplier is responsible for the accuracy of all gages. Work resulting from the use of "out of calibration" equipment or defective processes will be the gage supplier's responsibility and must be corrected without cost to Shape Corp. This includes the equipment and processes for any sub-suppliers.

- If a gage is used to qualify a part or process and the gage is found to be discrepant (at an initial validation), the Gage supplier may be charged for prevailing layout cost, air freight, part shipment charges and/or other charges directly related to the discrepant gage. Additionally, if a tool has been corrected using a gage that was not dimensionally correct, the Gage supplier may be charged for the tool work to correct the part.

2.3. Ownership

2.3.A. As soon as material is cut, the builder will label the fixture with property of Shape Corp. or (or OEM by name). Permanent marker or temporary tagging of any kind may be used for this initial identification.

2.3.B. All check fixture and gage design, CMM programming, innovations, trade secret and/or patents become property of gage owner (Shape Corp. or customer)

- A gage supplier may not disclose any development, devices or technical information to anyone outside of Shape Corp. - without written permission of the gage buyer.
- Only gage builder personnel or personnel approved by Shape Corp. Quality Engineer may inspect the gage during the design, build or tryout period.

2.3.C. A gage supplier may not photograph still images or record video images of any gage purchased for or through Shape Corp. during design, construction, inspection, storage or delivery without consent from Shape Corp. Buyer.

- All images are property of Shape Corp.
- No designs or image of gages may be used for advertisement or promotion without prior written consent from the gage buyer.

3. SAFETY AND ERGONOMIC REQUIREMENTS

3.1. General Requirements

3.1.A. The weight of the finished fixture and cart (separate weights) must be permanently on the gage using etching, tagging or other means.

3.1.B. Every effort must be made to design and manufacture a gage or fixture that is operator friendly. Associate safety is a value at Shape Corp., value that is carried over into equipment that is purchased.

- If there is any question about operator safety or task ergonomics after the gage is built, the Shape Corp. Engineer and Gage supplier will determine the course of action and financial responsibility.

3.1.C. The entire gage must be free of any sharp edges or burrs, paying very close attention to the "operator's area of movement."

3.2. Movable Details SAFETY

3.2.A. Movable details include but are not limited to toggle clamps, hinge drops, swing arms and:

- Must be free of pinch-point whenever possible.
- Must have mechanisms installed that prevent free falling onto the operator (Handle stops, toggle clamp lockout, hinge drop lockout). This pertains not only to a gage in its built position, but also if it will be rotated into a different orientation for inspection purposes.
- Must be fully within the base footprint.
- Moveable components (swing arms, e.g.) must be fully within the base footprint when open or fully extended

3.3. Weight

3.3.A. See Specifications Appendix for weight specifications

3.4. Height

3.4.A. Every effort to design and build the gage in a manner that is "operator friendly". The gage supplier may contact the Shape Corp. Ergonomics team for clarification.

3.4.B. See Specifications Appendix for height specifications

3.5. Reach

3.5.A. Reach should not exceed 25" when at all possible. If this is not achievable an ergo study will have to be conducted with Shapes Safety personnel prior to moving forward.

3.5.B. If the reach cannot be within 25" and/or fails the ergo study, then the gage design will have to accommodate a way to use a lift assist to get the part in and out of the gage. Shape Corp. Ergonomics team should be contacted to review gage/potential lift assist design.

4. QUOTE

4.1. Each gage quotation must include:

- 4.1.A. Program name
- 4.1.B. Part Description
- 4.1.C. Detailed description of work to be accomplished
- 4.1.D. Part Orientation
- 4.1.E. Design
- 4.1.F. Build
- 4.1.G. Tolerance Specification Reference (e.g. GM standard, Chrysler standard)
- 4.1.H. Preventive Maintenance Instructions
- 4.1.I. Certification (Third Party Certification must be performed if gage builder is not ISO/IEC17025 certified or if required by purchase order)
- 4.1.J. Gage R&R if unless waived on the purchase order
- 4.1.K. Quotation total cost
- 4.1.L. Itemized timing (timing for internal certification, third party certification must be included).

4.2. Quote is to be prompt, itemized and provided in a timely manner per Shape Corp. Quote Request.

- 4.2.A. Cost and timing assume that the gage supplier understands the specific quote requirements and the time of quotation. All other assumptions and/or exceptions that affect cost and timing must be clearly identified on the quotation.
- 4.2.B. Quote is to adhere to The Shape Corp. Check Fixture and Gage Build specification including customer specific requirements as required by the purchase order. If this is not possible the vendor may recommend alternatives. The Shape Corp. Quality Engineer must approve any alternative to the gage build requirements.

4.3. If the supplier requests a change on parts or prints being quoted they must note this on their quote along with price and delivery time.

5. DESIGN

5.1. These requirements are considered to be a minimum and may be superseded by individual customer requirements as approved by Shape's Quality Engineer or per purchase order specifications.

- 5.1.A. The Quality Engineer is responsible for communicating the requirements that deviate from the Shape Corp. Build requirements.
  - Communications to the gage builder via purchase order, Measurement System Analysis Planning or other method and
  - Communication to the project team via Tooling and Equipment Sign off.

5.2. The following must appear on all check fixture documentation including gage certification, gage designs, gage R&R and CMM layout data:

- 5.2.A. The Company tool asset number
- 5.2.B. The Company or Customer drawing number and revision level or part number and revision level (as these become available)

5.3. All designs must be reviewed and approved by the Shape Corp. Quality Engineer prior to ordering materials. This is to ensure check fixtures and gages have met all required tasks. It is still the vendor's responsibility to provide a check fixture or gage that meets all requirements as stated within.

5.3.A. Receipt of a hardcopy purchase order does not represent the start date of the work. The start date will be established when the purchase order number is given verbally or the receipt of the math data or prints, whichever comes later. The start date plus the quoted timing will establish the gage delivery date.

- All deviations from the delivery date must be communicated to the Shape Corp. Engineer in writing. Only circumstances fully outside of the gage supplier's control will be considered as acceptable program delays.

5.3.B. All work that is started without the purchase order number and/or math detail will be the supplier's responsibility if the program is delayed or cancelled.

5.3.C. All work performed with CAD or other customer data that is received by any source other than The Company will be the supplier's responsibility if the program is delayed or cancelled.

5.4. When engineering changes occur, all design and process changes must be identified, documented, reviewed and approved by a Shape Corp. Engineer before implementation. The supplier is required to document all changes on drawings and provide any updated material to Shape Corp. Revisions must also reflect whether engineering change is print or CAD data change.

5.4.A. No fixtures will be modified from the original design without the prior consent of the Shape Corp. representative.

5.4.B. All design changes should be submitted to in writing.

5.5. Shape Corp. may require a regular update report on the construction status.

5.6. The Shape Corp. team will make every effort to supply parts prior to gage delivery. In the event that parts are not available, the gage supplier is still responsible for part to gage clearance issues when the parts do arrive.

5.7. A gage supplier will maintain records of the engineering changes, process changes and rework methods along with the effective dates until notified by Shape Corp.

6. BUILD

6.1. Bases

6.1.A. As soon as possible after base is cut, the fixture will be identified with the PROPERTY OF information. Temporary identification methods may be used as long as the identification will remain on the fixture until a permanent tag is attached.

6.1.B. The fixture/gage for steel parts/component checks is to be made on a base material approved by the Shape Corp. Quality Engineer. The default is aluminum alloy Wolverine base and stanchions or equivalent material. See attached diagrams for welded bases.

- Note: Special consideration must be given in determining the base thickness when the fixture requires an exceptional amount of holes in base.

6.1.C. It is the gage supplier's responsibility to ensure that the base meets the flatness, parallelism and squareness tolerances as specified below. The datum scheme for these base measurements is defined as the base bottom as it sits in the horizontal position.

6.1.D. See Specifications Appendix for Recommended Base Specifications

6.1.E. Machined pads for all feet of gage are required or a solid plate for the entire surface which feet rest upon.

6.1.F. See Specifications Appendix for additional Base Specifications

6.2. Drill Bushings or Tooling Balls

6.2.A. Drill Bushings or Tooling balls are required whenever the check fixture is at a compound angle to the coordinate system.

6.2.B. See 10.2 Build Specifications for Drill Bushings or Tooling Ball Specifications

6.3. Variable Data Ports/SPC Ports

5.3.A Variable data port/SPC port bushing sizes inside diameters should be limited to two sizes: 3/8” (primary standard) and 1/2” (to be used in the event that a secondary port is needed to pokeyoke the use of a different indicator design).

6.4. Risers and Stanchions

6.4.A. Risers and stanchions may be relieved or cut away in certain areas to gain access to the part for dimensional inspection. It is the gage suppliers' responsibility to ensure the area(s) that are removed do not affect the integrity or stability of the gage or in any way violate the certification of the fixture.

6.4.B. See Specifications Appendix for Riser and Stanchion Specifications

6.5. Details

6.5.A. See Specifications Appendix for additional Detail Specifications

6.5.B. Shims may not be used unless approved in writing by the Shape Corp. Quality Engineer. If shims are allowed they must be full surface shims uniquely doweled to the feature to eliminate error when assembly/disassembly occurs.

6.5.C. Provisions for storing pins on the base are also required: clips, drilled holes in the base, etc.

6.5.D. Control Feature Identification must clearly be marked as follows:

- Net pad nominal
- Location lines clearly scribed and stamped
- Feeler wire handles clearly stamped with tolerance specifications for the GO/NO-GO ends and color coded for ease of use.
- Plug gages and Master control gages (when required).
- Master locator holes-pins or locators established using (1) four-way locator and (1) two-way locator.
- Pins for hole location-fixed pins should be used whenever possible.
- All checked-features must be checked to a point or feature on the gage itself.
- Gage blocks are not to be used to simulate feeler check or flush checks.

6.5.E. All points developed from a CAD file of the product must be on part surface and checked on gage metal.

6.5.F. Design of fixture/gage must allow for removal and proper replacement of critical areas of the fixture/gage (i.e. dowel pins).

6.5.G. Removable Details

- All details (wired, loose or bolted to fixture) and all accessory gages, (such as indicators and go/no-go gages), will be identified with feature dimensions and associated fixture's asset # & suffix number starting at -01 to the number of details attached to the fixture including indicators (ie S12340I001-01).

  6.5.G..1. A list of accessory gages with dimensions must be attached to the check fixture, if practical.

  6.5.G..2. A list of removable details with dimensions must be provided on a Bill of Materials.

- Individual accessory identification is used to aid in the development of Control Plans and re-certification of check fixture components on each fixture/gage

  6.5.G..1. When there are similar removable details used on the same gage, the details must have a unique locating scheme for each. Each detail and storage location must be clearly labeled or color-coded.

6.5.H. Hinged Details

- See Specifications Appendix for Hinged Detail Specifications

6.6. Locating Pins

6.6.A. See Specifications Appendix for Locating Pins Specifications

6.7. Clamps

6.7.A. All clamps must allow for maximum CMM access (low level, bayonet or toggle clamps are preferred placed away from the part edge).

6.7.B. There must be no interference when engaging the clamp.

6.7.C. See Specifications Appendix for Clamp specifications

6.8. Milled Grooves / Tolerance Bands

6.8.A. All milled grooves and tolerance bands must be colored to ensure good visibility for measurement.

- See Specifications Appendix for coloring specifications

6.8.B. Every effort must be made to minimize or eliminate the effect of the parallel error.

6.9. Build Tolerances

6.9.A. Tolerance specification requirements are defined in the quote and on the purchase order (e.g. GM standards, Chrysler standards)

6.9.B. Tolerances are established using the following gage certification datum scheme - the primary datum is the surface plane established by the tooling balls or base; the secondary datum is the longer line established by the tooling balls or base; the tertiary datum is the shorter line established by the tooling balls or base.

6.9.C. The tolerances shown below shall be enforced on all fixture/gages constructed. These requirements are considered to be a Shape Corp. required minimum and are superseded by individual customer requirements (as measured from 0/0 corner on the base or the master tooling ball and must be designated on the report that was used:

- Geometric Dimensioning and Tolerancing is to be used where required. The fixture/gage will be tooled to customer geometric tolerance standards when available, and all others to current (ASME GD&T/ANSI Y14.5M standard)
- For significant characteristics requiring data collection, the data is to be collected by variable means on the check fixture/gage and shall meet the following requirements:

  6.9.C..1. Plastic or wood may be used in the construction of fixture/gages with written approval from the Shape Corp. Quality Engineer.
- See Specifications Appendix for Tolerance Table

6.10. Corrosion Protection

6.10.A. See Specifications Appendix for corrosion protection specifications

6.11. Cart / Table

6.11.A. Casters

- 6 inch minimum caster required.

6.11.B. Height

- The height of the roller cart, including wheels and gage must meet the ergonomics' requirement.

  6.11.B..1. See the ergonomics requirements for total fixture height limits.

6.11.C. Identification

- The Asset # of the corresponding gage and “Property Of” information must be identified on each side of the cart.

6.11.D. A rack to hold up to 4 green tag parts underneath the base is required.

Example of green tag part rack

6.11.E. Part Shelf

- A pull out shelf to hold parts is recommend for all check fixtures that are being hand loaded.
- See Specifications Appendix for part shelf specifications

6.11.F. Inspection Check-Sheet Self
- An adjustable rod with table for holding the operator manual or check sheet may be required.

6.11.G. Cart color will be specified by Quality Engineer from Shape.

6.11.H. All fixtures must have a minimum of 2 tie down to hold fixture to base or cart.

7. LABELING

7.1. If a fixture is designed to only support/hold a product to allow stability prior to measurement, it is considered and should be identified as a "reference only" fixture. All other labeling requirements must be met. No tooling balls or measurable coordinates creating datum are needed on this type of fixture. Templates, if considered by the Quality Engineer to be "reference only," must be identified as "reference only," and Shape Corp. project number at a minimum.

7.2. All labeling on the gage must be legible and descriptive. The labeling must be placed in such a manner that it is readable when the part is on the fixture. Labels may be engraved, printed or stamped. If tags are used, they must be attached to the gage with screws or adhesives.

7.3. New Gages

7.3.A. All check fixtures/gages will be identified. Specific requirements will be provided by the Shape Corp. contact.

7.4. Changes

7.4.A. Each time the fixture/gage is modified, the gage house performing the modification is responsible to replace the identification and include the following information:
- Date
- Name of company performing modification
- Design change level
- Gage design change level

7.4.A..1. Construction date

7.4.A..2. Fixture / gage supplier name

8. DOCUMENTATION

8.1. The Shape Corp. Quality Engineer will be provided with

8.1.A. List of attachments (pins, indicators, feelers, etc) depicting material sizes and fully dimensioned.

8.1.B. Gage instructions (do not attach to the gage unless directed by the Quality Engineer)

8.1.C. One hard copy of all designs and actual CMM layout data report, including record of actual humidity (60% max) and temperature readings (68+/-5 f) during time of layout.

8.1.D. CMM layout data including:
- IGES file of fixture on CD
- Setup instruction
- Tolerance standard (e.g. GM specification; Chrysler specification)'
- Part CAD file used to build the fixture

8.1.D..1. All points must fall on part surface

8.1.E. Bill of Material defining all removable details
8.1.F. Copy of laboratory scope and A2LA/ISO17025 certification
8.1.G. Gage R&R R per OEM requirements or as defined by the Shape Quality Engineer
8.1.H. 3rd Party Certification (if required)
8.1.I. Gage Designs
8.1.J. Gage Certification(s)

9. MAINTENANCE AND RECORDS

9.1. All external purchased component suppliers/subcontractors are responsible to maintain Shape-owned fixtures and gages (held in their facility) in accordance to the TS16949:2002 and the Shape Corp. Supply Base Manual requirements. Copies of calibration records, adjustments, etc. must be supplied to Shape Corp. Quality Engineer in a timely manner.

10. SPECIFICATIONS APPENDIX

10.1. Safety and Ergonomic Specifications

10.1.A. Weight
- Any removable detail may not exceed 15 pounds without an assist device such as a counter balance.
- Handhold cutouts, handles, forklift sleeves or eyebolts must be installed whenever possible.

10.1.A..1. The following restrictions apply:
10.1.A..2. Fixtures < 40 pounds must have two (2) handles installed.
10.1.A..3. Fixtures > 40 pounds must have four (4) handles installed.
10.1.A..4. Fixtures > 65 pounds must have a dedicated cart of table with casters.
10.1.A..5. Fixtures >300 pounds must have eyebolts or forklift sleeves installed.

- Handles that are attached to the gage must have a minimum grip length of 4", a minimum grip width of 1" and a minimum hand access height of 1".

10.1.B. Height
- Working height of the gage on the cart is 41".

10.1.B..1. Maximum frequent arm elevation is 55"
10.1.B..2. Maximum lift of part

10.2. Build Specifications

10.2.A. Bases

- All edges must be machined square and beveled.
  - 10.2.A..1. The base must have the Zero Corners identified.
  - 10.2.A..2. All bases must be of uniform thickness.
  - 10.2.A..3. Tooling Balls or drill bushing in base
- When tooling balls are required:
  - 10.2.A..1. Three drill bushings or tooling balls with protective caps must be located and identified with the start coordinates on the base of the gages. All CMM points must be protected. Three tooling balls or drill bushings are recommended.
  - 10.2.A..2. Drill bushings are preferred. The drill bushings must be protected with a removable metal cover (not plastic). The cover must be designed so that it can't be snapped off because it becomes loose during normal use.
  - 10.2.A..3. The base must be stamped with X, Y, and Z location relative to Datum structures and identified with ORIGIN, ALIGN and PLANE.
  - 10.2.A..4. These CMM points/tooling balls/drill bushings will be used to establish the origin of the fixture for certification and part layout.
  - 10.2.A..5. Tooling ball base is recommended, but not required.
- When tooling balls are NOT required:
  - 10.2.A..1. Six (6) target points for layout must be stamped on the base.
  - 10.2.A..2. Target Point protection (e.g. bolted cover) recommended

10.2.B. Risers and Stanchions

- Risers and stanchions must be attached to the base securely with a minimum of two dowels and two cap screws unless specified in the design as a removable detail.

10.2.C. Details

- When removable stab-type pins are used; they must be secured on the fixture/gage by cable or equivalent device or in a storage block. (no retractable devices allowed)
- Stab pin checks must be unambiguous. Pins must clearly pass through the hole.
- Zero test blocks- must be attached to the fixture/gage base and positioned for easy access. Offsets for control checks shall meet the following criteria: Established with a 31.0mm, 50.0mm or 55.0mm nominal.

- All locator and go/no go pins and their receptacles must be made of O-1 or A-2 tool steel and hardened to Rockwell C hardness of 56-60 or equivalent as approved by the Shape Corp. Quality Engineer.
- Removable Details
  10.2.C..1. All surfaces that come in contact with feeler gages, taper gages and go-no pins must have surface ground pads that are made of O-1 or A-2 tool steel and hardened to Rockwell C hardness of 56-60 or equivalent as approved by the Shape Corp. Quality Engineer.
  10.2.C..2. All net pads must be removable and replaceable independently that are made of O-1 or A-2 tool steel and hardened to Rockwell C hardness of 56-60 or equivalent as approved by the Shape Corp. Quality Engineer.
- Hinged Details
  10.2.C..1. All hinged drop details must be counterbalanced or have a lockout mechanism installed. This also pertains if the gage will be tipped 90o to inspect the part.
  10.2.C..2. All hinge drop details must have stops installed (preferably rubber) to prevent damage.
  10.2.C..3. All hinged details must be constructed with minimum ½" thick steel.
  10.2.C..4. Shock-prevention mechanism is required for every SPC/VDI arm.
  10.2.C..5. Locks or stops are required at both ends of SPC/VDI arms and for feeler swings longer than 8 inches.
  10.2.C..6. Locating Pins

- All locating pins must be tapered and spring-loaded (RFS pin). The Gage buyer or Shape Corp. Engineer must approve all other pins (MMC pin or LMC pin).
- All tapered RFS pins must engage the part approximately at the mid-point of the taper.
- All locating pins must be made of hardened steel.
  10.2.C..1. If a locating pin must be locked out to load the part, the lockout mechanism must be positive. For instance, if a detail has an "L" shaped cut to lockout the locating pin, the cut must have enough lead in to disengage the locating pin and hold it out of position.
- The locating pin spring pressure must be strong enough to locate the part without distortion when clamped.

10.2.C..1. Spring loaded locating pins must move freely in all directions except the locating direction. Graphite lubricant is preferred, although lubricating oils may be used. It is essential that when lubricating oils are used the amount is not in excess. All excess lubricating oils must be wiped clean from the gage.

10.2.D. Clamps

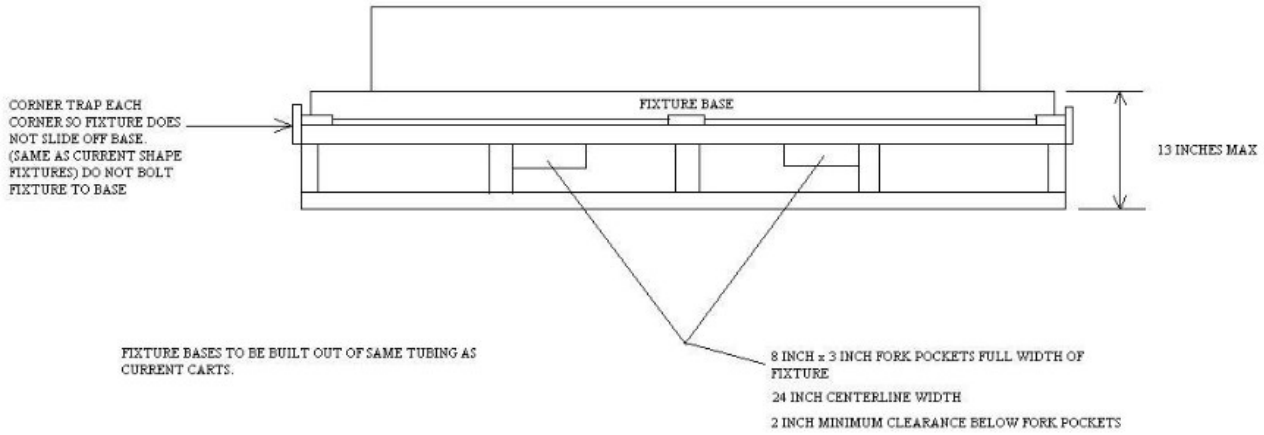
- All clamps must have a clamp direction of 90° to the part surface.
  10.2.D..1. Clamps that are spring loaded must have a positive lockout mechanism.
- When clamping over a hole, the clamp foot must be cut to allow access to the hole.
- In all cases, the clamp pressure must be the minimum required to locate the part, but stronger than the opposing spring-loaded features.
- All clamp feet must be mar-proof. If metal clamp feet are required, the must be free of burrs and sharp edges and have a mar-proof coating.
  10.2.D..1. Milled groove / Tolerance Bands
- Coloring specifications
  10.2.D..1. If a nominal line is included in the tolerance band, the nominal line must be black and the tolerance band on either side must be yellow. This includes a set of three scribed lines. The center one is black and the two outer ones are yellow.
  10.2.D..2. The gage base may be scribed with bodylines (not required). These lines do not have to be colored, but must be labeled with the proper coordinate.
  10.2.D..3. Corrosion Protection
- All steel components must be black oxide coated.
- All moving details must be lubricated. Excess lubricant must be wiped clean.
  10.2.D..1. Cart / Table
- Castors
  10.2.D..1. A fixture/gage cart must be a balanced roller cart with locking wheels or separate brake to allow for ease of handling and removal.
  10.2.D..2. The cart must be locked in place for use
  10.2.D..3. Castors, by specification, must be sufficient for the weight of the fixture and cart combined.
  10.2.D..4. Steel and rubber wrapped steel castors are not allowed.
  10.2.D..5. Castors must be at least 6” in diameter

- Part Shelf

  10.2.D..1. A pull out shelf to hold parts is required for parts that weigh >7#.

11. FIXTURE TABLE REQUIREMENTS FOR COMSTOCK PLANT ONLY

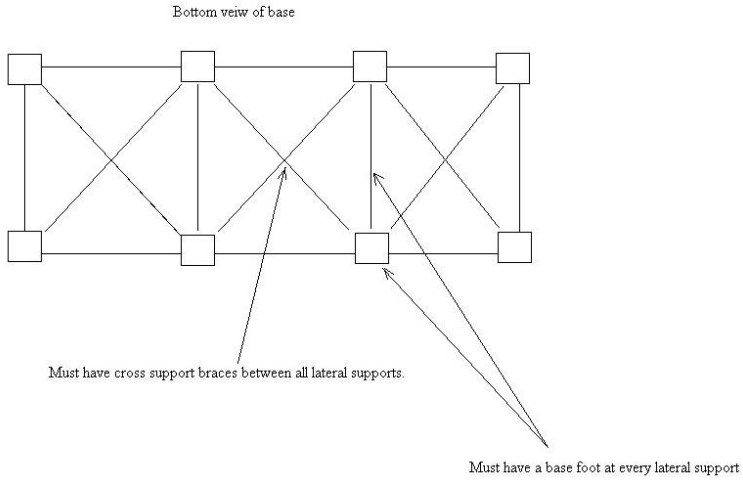
Comstock Fixture requirements table



12. RECOMMENDED BASE SPECIFICATIONS

i. Note: all tolerances specified are in mm

⌓	0.10	A	Per 300 mm^2
⌓	0.20	A	Not to exceed over entire base
//	0.10	A	Between top and bottom surfaces
□	0.15		All machined edges



B. Tolerance Table

	Build
Net and Datum Surface	+/- 0.1mm (0.0039 in)
4 Way Locators (location)	+/- 0.1mm (0.0039 in)
2 Way Locators (location direction) (non-locating direction)	 +/- 0.1mm (0.0039 in) +/-0.15mm (0.0059 in)
SPC/VDI Bushings (distance to surface) (location of bushing)	 +/- 0.1mm (0.0039 in) +/-0.25mm (0.0098 in)
Feeler Surfaces	+/-0.15mm (0.0059 in)
Flush surfaces	+/-0.15mm (0.0059 in)
Sight checks (size) (location)	+/-0.25mm (0.0098 in) +/-0.25mm (0.0098 in)
Scribe lines (location)	+/-0.25mm (0.0098 in)
Stab/Pin checks (size) (location)	+/- 0.025 (0.001in) +/- 0.15 (.0059 in)
Go/No-Go Plug Gages (go) (no-go)	+ 0.02/-0.00mm (0.0008/0.0000 in) +0.00/-0.02mm (0.0000/0.0008 in)
Go/No-Go Feeler Gages (go) (no-go)	+0.02/-0.00mm (0.0008/0.0000 in) +0.00/-0.02mm (0.0000/0.0008in)